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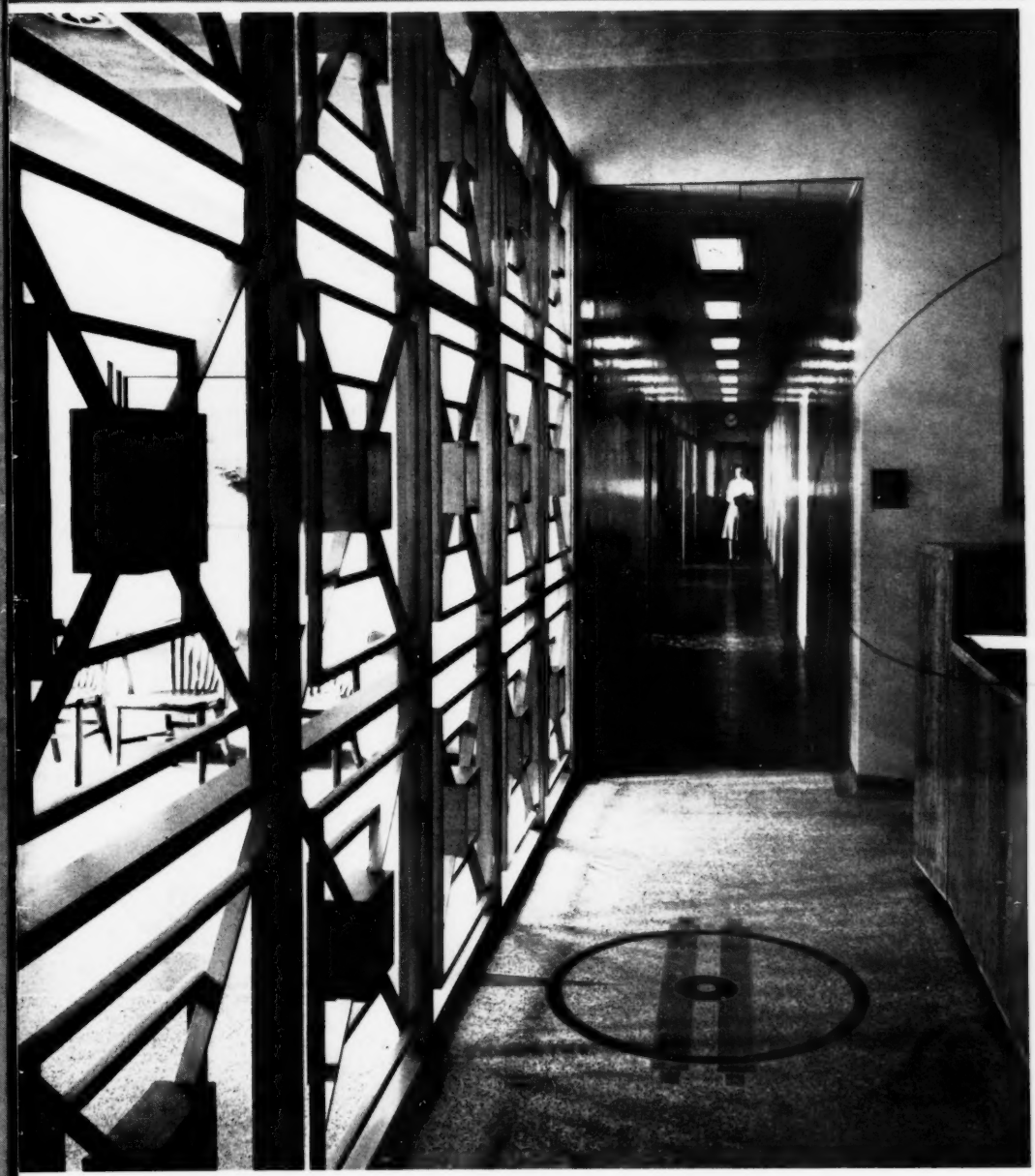

Topics

LIGHTING

SOLVENT POISONING

and

SMOKE CONTROL

Occupational Health Division

DEPARTMENT OF NATIONAL HEALTH AND WELFARE, OTTAWA

Occupational Health Review

Volume 9, Number 2, July, 1957

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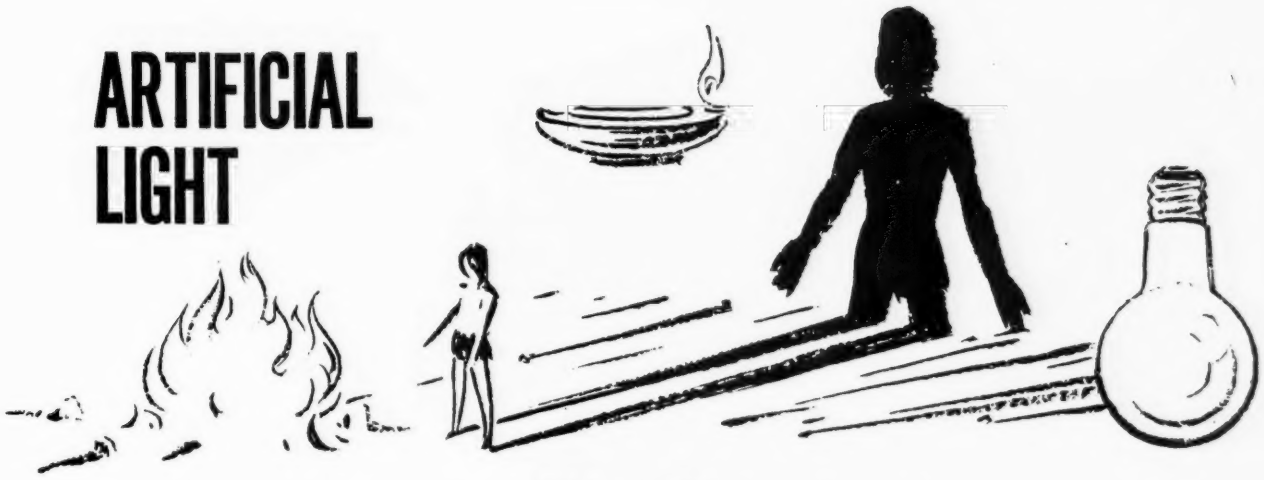
COVER PLATE

The photograph on the cover, by Malak, shows a modern method of inset lighting in a hallway.

ARTIFICIAL LIGHT



by J. H. Grove, M.D.,
Chief, Blindness Control Division, Dept. of National Health & Welfare, Ottawa.

Man has used artificial light since the early stone age. At first the light came from camp fires. Then, some bright person, no doubt observing how well animal fat burned, melted some into a hollowed-out stone or a segment of an animal skull, inserted a wick of moss, lit the oil-soaked wick and produced the first lamp. The light was flickering and smoky but it served its purpose. This principle of the open flame for artificial illumination was unchanged until the time of the electric light. Even today half the world depends solely on oil lamps and candles.

Although enclosed lamps and lanterns of a sort had been in use since Roman times they gave only a poor flickering smoky light. The first essential change in principle of oil lamps was made by Argand in 1785. He developed a lamp with a round burner and a cloth wick. The flame was enclosed in a round glass chimney. The chimney not only directed the air to the burner but enabled the flame to burn steadily to produce a clean bright light. In short, Argand invented the modern oil lamp. This type of lamp and its oil fuel were expensive and only used by the well-to-do. The poor could not afford oil for lamps until sometime after the first oil well was drilled in Pennsylvania in 1859.

Although the Chinese had used natural gas as an illuminant in certain salt mines many hundreds of years ago, the first practical use of illuminating gas distilled from coal was in England in 1790. After 1810 it began to be used commercially to light public buildings, factories and streets on both sides of the Atlantic. Fifty years later its use had extended into many homes.

In 1802 Davy discovered that an arc light could be produced by passing an electric current across the gap between two carbon electrodes. Two years later the wet cell battery was invented. But it was not until 1840 that a workable arc lamp was produced and not until 1875 that a dynamo was made that would produce a current strong enough for practical electric lighting. By this time many scientists had produced incandescent electric lights, but these were too short lived to be of practical use. The electric arc lamp was improved by Brush in 1877, and in 1879 Edison, ingeniously adapting the discoveries of previous workers, produced the first practical incandescent lamp which revolutionized artificial lighting. The Edison Lamp consisted of an air-evacuated clear glass bulb with a carbon thread filament. The filament was heated to incandescence by its resistance to the flowing electric current, thus producing a bright light. The lack of oxygen prevented the rapid disintegration of the carbon filament. This lamp is unchanged in principle to the present day.

The electric industry has developed purely on a scientific and engineering basis, but the proper application of electric lighting was hindered for a long time by the prevailing belief, honoured by long usage, that if there was enough light to see the work no more was necessary or desirable. As a result the levels of artificial illumination at the turn of the century were no more than 1/50 of those recommended and commonly used today. It was thought that too much electric light was bad for the eyes. However, this is only true if the light glares into the eyes long enough to fatigue them.

We should not be too scornful or critical of the lighting in those days. After all, the world progressed and performed its work quite well before electric lights were invented. The human eye has great flexibility of function and useful vision is possible under very poor light. Before the era of modern lighting everyone was accustomed to working indoors under poor light especially at night. This was accepted as a matter of course. Better light would have been preferred but was not considered practical. Those who had to work, read or study under the poor light did so even though they found it difficult and tiresome. It was not recognized then and is still not fully appreciated that the better the light, the easier the seeing. In fact, the commonest

cause of eyestrain is prolonged close eyework under improper light. This situation may mean insufficient light, too glaring light, or bright light on the task creating too great a contrast with a dark environmental background. Under any or all of these conditions, the muscles which change the focus of the lens for near or far vision, or alter the size of the pupil to let in more or less light, become fatigued from overwork as they continually make alterations in an effort to improve the vision. In addition, glare fatigues the light receptive nerve cells of the retina, resulting in blurring and reduction of vision.

Before proceeding further a few facts should be mentioned about light itself and its effects on the eyes. Light can be defined as visible radiant energy, travelling in waves. Although the wave theory does not fit all the facts it can be assumed for practical purposes that light proceeds in waves of short lengths which are confined to a narrow band of the electro-magnetic spectrum. The shortest visible waves produce violet. Next in order of increasing wave length are blue, green, yellow, orange and red. These colours comprise the visible spectrum. On either end of the visible spectrum there are invisible light rays. On the violet end are the ultra violet rays, slightly shorter in wave length than the violet. These have germicidal and biochemical effects, and are essential to the maintenance of health. They also have photo-electric and fluorescent properties. The waves longer than visible red are called infra-red and they produce heat.

All these waves can be demonstrated by turning on an electric heating element. First noted is the warmth of the infra-red rays, then as the effect of the current increases the molecular action, the element glows a dull red. As the current increases the element becomes bright red and finally white hot. If the element contains tungsten a small part of the energy will be transformed into invisible ultra violet waves.

Light flows out in all directions from a point source. The amount or intensity of the light is commonly measured in foot candles by means of photoelectric meters.*

Although we commonly speak of visible light waves we do not actually see them as they flow. What we do see is the effect of light after it enters the eyes. As an illustration of this fact, if you go outdoors on a clear dark night and turn on a flashlight, you will see no beam of light if you point the flashlight up to the sky, provided there is no dust, smoke or fog in the air. Next, point the flashlight at some object 20 or 30 feet away. The object is lit up by the light, but you will still see no beam of light if the air is clear. If you do see a beam of light from any source it is because tiny objects are in the path of the light. These fine objects intercept the light and reflect some of it back into the eyes, creating the appearance of a light beam. Light, then, is only visible to us after it enters the eye and stimulates the retina. The retina then sends nerve impulses to the brain, which are interpreted as a visible image of an object looked at.

Although foot candles define the amount of light coming from a source, they do not indicate the brightness of objects exposed to the light. Their brightness depends upon how much of the incident light they absorb and how much they reflect. The colour of objects will also depend on what wave lengths they absorb and reflect. For example, a red appearing object absorbs all wave lengths but red. Colour is important in the study of illumination.

Brightness is a sensation. If the brightness comes directly from a light source, its intensity will depend on the number of foot candles of light which strikes the object, divided by its reflection factor. Black cloth appears dark because its reflection factor is low. White paper appears bright because its reflection factor is high. For this reason the amount of foot candles of light which strikes an object is no measure of how bright the object will appear. Its brightness will depend on how much of the incident light it will reflect into the eye. It is important therefore in providing sufficient light for good seeing to take into account the reflection factor of objects which are to be made clearly visible. Brightness is measured in foot lamberts for objects of low brightness and in candles per sq. inch for light sources. In designing lighting systems, the foot candle is the more practical unit of measurement.

An important property of light is its rapid decrease in intensity as the distance from its source is increased. For example, light from a source of 100 foot candles is reduced to 25 foot candles at 20 feet distance and 9.4 foot candles at 30 feet (Law of inverse squares).

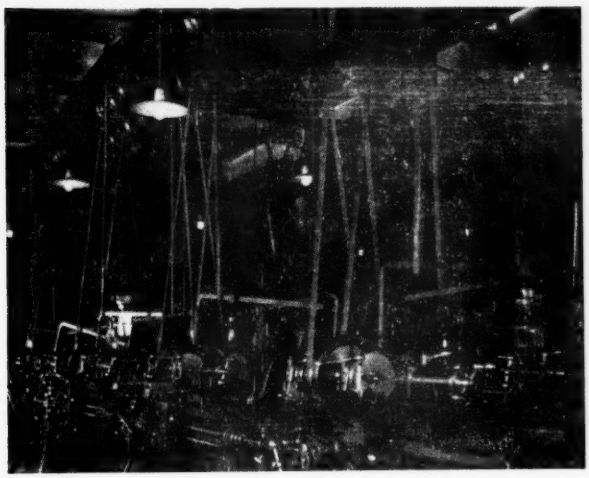
This fact and the equally important one that brightness of objects depends on their reflectance is not taken into account often enough when lighting fixtures or windows for daylighting are installed by 'rule of thumb' methods.

Advances in artificial illumination and in daylighting did not come about automatically. They were the result of much research and experimentation almost entirely by the lighting industry itself. The first electric lights were usually dropped singly by a cord from the ceiling. They supplied perhaps ½ to 1 foot candle of light on the work and appeared merely as isolated spots of brightness in a surrounding atmosphere of gloom, especially at night. Indoor electric lighting before and for some time after 1900 gave little or no better illumination than that furnished by gas mantles or oil lamps. Sometimes the electric lighting was of poorer quantity and quality. By the turn of the century opaque shades to direct the light downward began to come into use. The shades brightened up the work but the greater resulting contrast of the light area with the dark environmental background tended to increase the incidence of

*One foot candle is the amount of light delivered on to one square foot of a surface one foot distant from the candle.

eye strain. Workers commonly wore green eye shades to cut down on glare.

In the early 1900's, streets, factories and mills were lit either by electric light or by illuminating gas. The lighting in offices, stores and homes was still mainly by gas or oil lamp, although electric lighting was beginning to gain a foothold. In schools the only light in classrooms was daylight. Even on bright days poor window location left dark corners and poor visibility of the chalk board. On dull days schoolwork was greatly hampered by poor light.



(From Illuminating Engineering)

1. An Example of Early Shop Lighting

The realization that improvements in electric lamps and their method of use were urgently necessary, led to the formation of the Illuminating Engineering Society of New York in 1906. The deliberations of this and similar societies formed later in other countries and the research they stimulated has resulted in raising artificial illumination to its present status as a science and an art. Not only have electric lamps and sources of electricity been tremendously improved and made less costly, but the principles of how to use them have been gradually elucidated. Improvements in daylighting by windows followed, but this trend did not start until about 1925.

A great stimulus toward better lighting was created by the demands of two World Wars. The cost of improved lighting was more than offset by increased efficiency of production and betterment of visual working conditions, with consequent improvement of worker morale. Accustomed as we are to scientific advances of all kinds, we are prone to forget how recent these lighting developments are. We should realize that much of our modern progress, especially in industry, has been made possible only by better illumination.

At the time the Illuminating Engineering Society was formed in 1906, levels of illumination for work ranged from 2 to 3 foot candles. No engineer could lay down specifications for the production of a definite amount of light in a given work area. There was no easy and accurate way of measuring light. No one knew how much light was necessary for good seeing indoors, or how good seeing conditions could be attained.

In 1906 only a few engineers thought that the quantity and quality of light should be greatly increased. Few indeed were prepared to accept the revelations of Lewison when he shocked the engineering world in 1908 by pointing out that the diffuse daylight overhead on a clear day represents 12,000 foot candles and that even on a cloudy day the daylight is of the order of 1000 foot candles. These facts were disclosed at a time when engineers were arguing whether or not 4 foot candles was enough illumination for accurate fine work. Lewison's correct revelations were not generally accepted at the time and it was long before adequate levels of artificial illumination were generally accepted. It should have been obvious to doctors as well as to engineers that, since the human eye has developed to see best in daylight and since daylight does not harm the eyes, man should see better indoors with light which approaches the quality and quantity of daylight.

In 1915 the Illuminating Engineering Society issued its first code of industrial lighting; a code for school lighting soon followed. Recommended levels of illumination for work still ranged only from 2 to 3 foot candles. Electric lighting was introduced into a few schools in 1908. Matthew Luckiesh, one of the great leaders in promoting better lighting over the last 40 years or so, began his investigations into school lighting about 1914. In 1915 he published an article criticizing artificial lighting in schools because of glare from low chandeliers. At this time recommended lighting was 3 foot candles for classrooms and 6 to 12 foot candles for sewing and drafting rooms in schools.

Levels of illumination in factories at the start of World War I were 3 to 5 foot candles. This was about as much light as could be delivered at the time because of the limited efficiency of lighting installations (or luminaries) and the scarcity and high cost of electricity. During the war there was great need for increased production of all kinds. This situation necessitated longer work hours and multiple work shifts. As a result of the demand, improved electric lamps and increased supplies of electricity were furnished, the cost being justified by increased work production. By 1918 levels of illumination had risen to 7 or even 10 foot candles. Experiments indicated that levels of 12 to 20 foot candles and more general brightness in work areas made still greater production possible.

Many of the advances in illumination proceeded from research in the laboratories of the General Electric Company, starting in 1913 and becoming a full fledged light laboratory in 1924 under Dr. Matthew Luckiesh.

Levels of work illumination for work had risen as high as 20 to 35 foot candles by 1930. In school the levels were not nearly so high. The advances in lighting

practices were made possible by constant improvements in the efficiency of lamps, both incandescent and mercury arc. Neon lights were introduced for sign lighting.

The advent of the fluorescent lamp in 1938 opened the way for still higher quality and levels of illumination. Fluorescent light is generally superior to incandescent or arc lighting except for special purposes. The fluorescence is produced by ultra-violet waves acting on phosphors which line the inside of the fluorescent lamp tubes. The light is soft, cool, relatively shadow-free, and non-glaring when properly shielded or located above eye level. It is therefore easy on the eyes and can be distributed by properly situated luminaries to produce even lighting over wide areas. Fluorescent light is more efficient than incandescent light and relatively cheaper because of the longer life of the fluorescent lamp.

(From American Standard Practice for School Lighting)

2. An Example of Glare in a Schoolroom

During World War II, fluorescent lighting was widely adopted in industry because of the necessity for better light to increase production, even though at the time fluorescent light was more expensive than incandescent. Levels of illumination rose to 50 foot candles in industry. Since the war fluorescent lighting has come into more general use, although incandescent light still fulfils a useful purpose. Over the years, co-incident with increased levels of illumination, more attention has been paid to a general brightening of indoor environment.

With all these advances in lighting, and with the means to procure it readily available, there should be better lighting practices than are commonly found. Although industry, business organizations and stores have generally adopted modern lighting practices, there is still a great deal of poor indoor lighting even in some new buildings and homes. Some of the lighting in older buildings, schools and homes is little or no better than it was 30 to 40 years ago.

Let us now consider some factors involved in the production of good seeing conditions. A few comments on the eyes and vision are applicable at this point. Most people possess normal vision or can have their vision brought up to normal or nearly so with proper eyeglasses. Increasing age, however, has an adverse effect on the vision even if no eye disease supervenes. After age 45 or a few years later, nearly everyone has to wear reading glasses for close eye work in order to make up for gradual loss of accommodation (ability to focus eyes to see near objects well). In addition, in older persons the pupils of the eyes commonly remain smaller in diameter than in youth. This decrease in pupil diameter excludes considerable light so that on the average a person aged 60 needs 30% more light to see fine details as well as when he was 25 years old. Furthermore, if there is any defect of vision due to marked errors of refraction, hyperopia (long sight) myopia (short sight) or astigmatism (irregular blurred vision) more light is necessary for a person to see well than if the vision is normal.

In addition to good vision, good seeing of an object necessitates enough good quality light to provide brightness, and proper contrast. If the details to be distinguished are very fine, the time of viewing is important. With good light, fine details are seen more quickly and the eye is not fatigued so easily as with poor light.

Quantity and Quality of Light

Quantity—The more light on the task the brighter it will be. The amount of light necessary depends on the type of work. If it requires accuracy, speed, attention to fine details, particularly when there are only slight contrasts of colour and the materials or objects are dark, a great deal of light may be necessary to make the task easily visible. The amount of light which can be used effectively has not yet been established.

Recommended levels of illumination now range through 5 to 10 foot candles for rough and casual seeing tasks, 30 to 40 foot candles for ordinary tasks, 50 foot candles for more difficult tasks, 100 to 200 foot candles for fine precision work, 300 to 500 foot candles for merchandise displays and store windows and 1000 foot candles or more for inspection purposes. Tables of recommended levels of illumination are given in the manuals listed at the end of this article.

Quality—Mere quantity of light alone is no criterion of adequate lighting. If the light is not of proper quality, its purpose will be defeated. Light of desirable quality will not glare into the eyes; it will be widely and uniformly diffused; it will be of pleasing colour, sufficiently bright for the specific eye work; and will not offer so great a contrast with the general environment as to produce eyestrain.

Glare is brightness that irritates and fatigues the eyes. It may come directly from a light source or

indirectly as reflections from polished surfaces or other reflecting materials like glass, snow, sand or water. Glare from artificial light sources may be reduced by diminishing the brightness of the light source, installing proper shades on the light, raising the light source above the line of ordinary vision or increasing the brightness of the general area around the light source.

Reflected glare may be difficult to reduce. It can be diminished by the use of flat finishes on walls, machinery, furniture, etc.

(Photo by Malak)

3. Modern Office Lighting

In order to create a general atmosphere of brightness in a room, the ceilings should be white and the walls light colours. The lighting fixtures should direct 10% of the light upwards to the ceiling. White ceilings will reflect 80% of the light, and light coloured walls 50% to 70%. Machines, desks, benches and furniture should be light in colour to reflect 30% to 50% of the light. Floors should be sufficiently light in colour to reflect 15% of the light. All finishes should be flat to prevent dazzling reflections.

Colour can be used to produce a pleasing atmosphere. Walls of ivory or buff are warm and make a room look smaller. Green and blue are cool and make a room look larger. Grey is neutral but tends to become monotonous. In the interest of worker safety, moving parts of machines can be painted in different colours from stationary parts. The whole accent now is on pleasing brightness for all places of work.

Daylighting is important. Few buildings can dispense entirely with artificial light by day. The artificial lighting should be balanced with the window lighting so there will be no dark areas and no glare. Windows, therefore, need shades to keep out direct sunlight.

Production of Artificial Light

The production of good lighting by modern standards is a highly scientific and complicated procedure. Only a lighting engineer can design such a lighting system. He should have the co-operation of the architect when new buildings are involved in order to combine the skills of both professions to produce the best lighting result. This does not mean that it is always necessary or practical to engage a lighting engineer to design small lighting systems or alter existing ones. There is a comprehensive handbook on lighting and also numerous booklets on special lighting practices, published by the Illuminating Engineering Society. A partial list of these publications is given at the end of this article. By their aid, technicians can be guided to install or alter some lighting systems.

This article has just touched on some of the aspects of artificial lighting. It is hoped that it will stimulate more interest in the production of better lighting and that it will emphasize the need for expert help in solving lighting problems.

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I.E.S. Handbook, 2nd Edit. 1954.

Industrial Lighting. Illum. Eng. Col. LI., No. 1, Jan. 1956.

Quest for Quality in Office Lighting. Illum. Eng. Vol. LI., No. 1, Jan. 1956.

The Birth and Development of School Lighting. Ill. Eng. Vol. LI., No. 1, Jan. 1956.

The Lamp Maker's Story. Illum. Eng. Vol. LI., No. 1, Jan. 1956.

Residence Lighting during the past Fifty years. III. Eng. Vol. LI., No. 1, Jan. 1956.

Encyclopaedia Britannica.

Communication from Sylvester K. Guth, Manager, Radient Energy Effects Laboratory, Gen. Elect. Co., Feb. 1957.

Partial list of publications of the Illuminating Engineering Society, 1860 Broadway, New York, 23, N.Y.U.S.A.

# 1.	I.E.S. Lighting Handbook, 2nd edition, 987 pages—$8.00	
	Booklets	
# 2.	Office Lighting	.50¢
# 3.	Stores and Merchandising areas	.50¢
# 4.	School lighting	.50¢
# 6.	Daylighting	.50¢
# 8.	Industrial lighting	.50¢
#11.	Residence Lighting	$1.00
#36.	Lighting Fundamentals	$1.00

Three of the many codes published by Canadian Standards Association, 235 Montreal Road, Ottawa 2, Ontario.

C 92 1.	Canadian Standard Practice of Industrial Lighting	.50¢
C 92 2.	Canadian Standard Practice, Street and Highway Lighting	.50¢
Z 94	Code for Head and Eye protection	$1.00

ANNUAL REPORT
ONTARIO ALCOHOLISM RESEARCH FOUNDATION*

A rapidly growing population of alcoholics in Ontario, with a consequent demand for more treatment services, basic research, and public education highlights the sixth annual report of the province's Alcoholism Research Foundation. This 100-page report on 1956 operations was tabled in the Legislature by Dr. Mackinnon Phillips, Minister of Health.

The report notes an increase of 178 per cent in numbers of alcoholics in Ontario from 1945 (28,050) to the end of 1956 (estimated at 76,000). The rate of alcoholism has gone up from 1,040 per 100,000 adult population in 1945 to 2,210 per 100,000 in 1956.

"Certain facts regarding our situation here in Ontario are indisputable," observes H. David Archibald, executive director of the Foundation. "The number of citizens of Ontario who have developed this illness is very large; this number is increasing year by year at an alarming rate; and the special clinics operated by the Foundation, the mental institutions of our province, Alcoholics Anonymous, and other treatment organizations are handling only a fraction of the new cases which develop each year . . .

Half U.S. Rate

"It may be somewhat comforting to realize that the rate in Canada at the present time is approximately half that of the United States; but our rate is climbing rapidly and we have no reason for complacency."

In his annual statement, I. P. McNabb, Foundation chairman, speaks of the increase in staff necessitated by pressing demands for service since the inception of this alcoholism control program in 1949. This growth has resulted in overloading of the Foundation's two buildings on Bedford Road, Toronto, and has made it necessary to rent additional space nearby to accommodate the research department.

Demands on London and Ottawa Branches are also making enlarged quarters imperative for the out-patient clinics operated in these two centres.

"During the past year, increasing emphasis has been placed on acquiring a strong research staff with a view to undertaking major research efforts within the organization," the chairman reports. "In keeping with this policy a new position, Director of Research, was created during 1956. We were fortunate to be able to appoint John R. Seeley to this position in the latter part of the year."

Progress through Research

Mr. McNabb holds out no hope for "a quick and spectacular solution to a problem as old and complex as alcoholism". He forsees no magic inoculation against this illness; but he does anticipate in the next few years "more progress than ever before toward a solution".

"Such progress will be achieved only if we maintain a vigorous research program in order to develop an increasing body of knowledge concerning alcoholism and its ramifications," declares Mr. McNabb.

To date the Foundation has undertaken 45 research projects—15 conducted by the staff of the Foundation, and 30 carried out in hospitals and universities of the province on grants made by the Foundation. These range from clinical studies in psychiatry, psychology and medicine, to laboratory work in physiology, pharmacology and biochemistry, and extensive work in the fields of sociology and anthropology.

New Drug Developed

One of the projects which is of special importance to the clinician in the field of alcoholism is the three-year search for a drug which, like Antabuse, would render the effect of alcohol unpleasant to the drinker, but which would be free of some of the latter's drug's reported side effects. This was carried out under the direction of

*A sumanary of the activities of the Ontario Alcoholism Research Foundation.

Dr. J. K. W. Ferguson, Chairman of the Foundation's medical advisory board and director of the Connaught Medical Research Laboratory. This work has resulted in a new drug, citrated calcium carbimide (CCC) which has had very encouraging clinical trials to date.

"It now appears that CCC will offer the physician a valuable means of assisting in the treatment of alcoholism," states Mr. Archibald. "Plans are now being formulated with a drug company to market CCC in quantity. It must be stressed, however, that this drug is to be used only under a medical doctor's direction".

Investment in Education

Public education received the smallest share of the Foundation's $267,000 budget in 1956—$36,500. This is, however, an increase of 10 per cent over the previous year's allocation; and it takes no account of the generous space donated to articles about alcoholism in the daily, weekly and periodical press of Canada, and the time donated by radio and television stations. Many times the dollar investment is thus realized as a result of the intrinsic human interest in this subject and the co-operation of editors and producers with the Foundation's education department.

"Control and prevention of alcoholism is the most fundamental aim of the Foundation," asserts the executive director. "It is assumed that prevention will not be possible until more facts are known about the character of this disease, its early signs, its natural history, and methods of correction. Hence the need for research and experimental rehabilitation programs. It is further assumed that prevention will not be possible until the facts derived from research and clinical experience are transmitted to all individuals and groups in this country. Hence the need for a program of education. The two programs are complementary — research and clinical work which develop the body of knowledge, and education which bridges the gap between the research laboratory and the community . . . Once such knowledge is transmitted, however, its application must remain the responsibility of the recipients."

Educational Gains

That segments of the community are accepting responsibility for acquiring and using knowledge of alcoholism is evident from the report. During 1956, some 31 industrial companies, representing more than 56,000 employees initiated programs of enlightenment about problem drinking. Other major groups, such as the Royal Canadian Air Force and the Government of Canada Public Service have taken steps to modify their handling of alcoholic employees and to conduct widespread education programs. Delegates of major denominations belonging to the Christian Social Council of Canada have participated in a series of seminars at the Foundation. And as the year closed, the Foundation was cooperating with the Ontario Education Association to sponsor a 1½ day program on alcohol studies at the 1957 convention of school teachers in Toronto during the Easter vacation. This, in addition to filling more than 100 requests for public addresses to a variety of community organizations throughout the province during the past year, and conducting classes on alcoholism for students in nursing, occupational therapy, medicine, public health, and social work.

More than 4,000 Patients

On the treatment side, Brookside Clinic in Toronto has served 3,352 patients since 1951 — roughly 70 per cent of these from the Greater Toronto area and 30 per cent from elsewhere in Ontario. Branch clinics in London, Ottawa, and Kingston have treated 712 new patients. The greatest single source of these patients has been through referral from general physicians in Ontario (22 per cent); while Alcoholics Anonymous have referred some 13 per cent of the total, and another 13 per cent were encouraged by family and friends to seek help for their drinking problem. Smaller, but increasing numbers, have been referred by industrial physicians, employers, social agencies, members of the clergy, and the courts.

Majority Not Treated

"It is obvious that most of the alcoholic individuals in our communities are not getting treatment, nor have they ever had treatment," comments Dr. John D. Armstrong, medical director of the Foundation. "At the same time, these people are creating tremendous damage to the community in terms of economic losses as the result of absenteeism from work; social damage because of their impact on the home; or, more directly, physical damage to property and to other humans as a result of the hostile, agressive behavior of a drunken person; and, lastly but equally important, the self-destructive implications of unchecked alcoholic disease in the individual".

Dr. Armstrong points out that a move is afoot at the present time to work toward a possible revision both of related laws and facilities in the province for the treatment of alcoholics. He adds, however: "It is quite obvious that if any change in attitude or law should bring a greater demand on the Foundation for treatment than already exists, we have no capacity whatsoever to meet it."

CARBON TETRACHLORIDE

AN UNDER-RATED HAZARD*

by Guy E. Joron, M.D.,
McGill University Clinic, Montreal General Hospital, Montreal, P.Q.

The object of this paper is to call attention once again to the hazards of exposure to carbon tetrachloride. This may seem unnecessary when every physician knows that carbon tetrachloride can produce fatal liver damage. Indeed, because of this, its industrial uses have been curtailed notwithstanding superior qualities as a solvent and dry cleaning agent. However, our experience has shown that the public is largely unaware of its toxicity, and cases of poisoning continue to arise from its use in the home or on a small scale in industry.

Not infrequently, the patient does not associate his illness with previous exposure to carbon tetrachloride and fails to mention the exposure to his physician. In addition, physicians often do not realize that acute renal failure is a much more common manifestation of poisoning by carbon tetrachloride than is massive necrosis of the liver. Thus it follows that the correct diagnosis is not suspected by either patient or physician.

Carbon tetrachloride has a long medical history dated from 1865 when it was suggested that it might be a useful anaesthetic agent. It was soon abandoned for this purpose because depth of anaesthesis could not be properly judged and sudden death resulted.

In 1921 its use was advocated for hookworm infestation. During the next ten years it was proven that it could cause central necrosis of the liver and renal damage. In fact the use of carbon tetrachloride to produce liver necrosis has become an accepted technique in experimental medicine. Review of several recent text books of pathology shows that the only reference to carbon tetrachloride is its action on the liver. In the last 15 years however it has been shown that in humans the most common significant lesion is acute injury to the tubules of the kidney producing acute renal failure or as it is sometimes called lower nephron nephrosis. Oliver has shown by microdissection of individual nephrons that the lesions may be found throughout the length of the tubule. Hence the terms acute renal failure or acute tubular injury are to be preferred to lower nephron nephrosis. The commonest causes of acute renal failure are surgical and obstetrical emergencies such as haemorrhagic or traumatic shock and mismatched transfusions. However it is important to realize that if one can exclude such conditions the commonest medical cause of acute renal failure in this part of the world is carbon tetrachloride intoxication. This may follow its inhalation, ingestion or absorption through the intact skin. Ingestion of alcohol before, during, or soon after exposure greatly increases the likelihood of renal damage.

Reports of Cases

Table I summarizes the last twelve cases of carbon tetrachloride poisoning which we have seen during the past seven years.

Case 1. While this man was drinking beer with his friends, a practical joker refilled his glass with carbon tetrachloride. After a few gulps he noticed the prank, became nauseated but did not vomit. He developed acute renal failure and died.

Case 2. Epigastric pain and vomiting started suddenly after supper. His physician made a diagnosis of duodenal ulcer and treated him accordingly for a week. He continued to vomit, grew weaker and drowsy and was brought to hospital. On admission he had a generalized seizure. In view of the elevated blood urea nitrogen, albumin and red cells in the urine and the sudden onset of the illness, acute renal tubular injury was suspected. Since carbon tetrachloride is the commonest medical cause of this condition he was ques-

*Reprinted from the Canadian Medical Association Journal, February 1, 1957.

tioned specifically about the possibility of exposure. It was found that 9 days previously he had been extracting artificial fibres through carbon tetrachloride. That afternoon he had had two bottles of beer. His symptoms started that night. He made a complete recovery.

Case 3. Patient gave a typical story of cholecystitis. She was given 1000 ccs of fluids intravenously and her condition improved. The next day this was repeated and the patient commented that her rings felt tight. It was then noted that her bladder contained only a few ccs of bloody urine. She was admitted with a diagnosis of acute renal failure of unknown origin. Direct questioning revealed that 4 days previously she had cleaned her chesterfield with carbon tetrachloride while having a bottle of beer. She ran a stormy course with a hypertensive crisis of 230/150 and generalized seizures on the 4th day of diuresis. She eventually made a complete recovery.

Case	Sex	Age	Mode of exposure	Concomitant alcohol ingestion	Acute renal failure
1	M	70	Ingestion	+	+
2	M	37	Inhalation	+	+
3	F	37	Inhalation	+	+
4	M	37	Inhalation	+	+
5	M	39	Inhalation	+	+
6	M	45	Ingestion	+	+
7	F	40	Ingestion	+	+
8	M	26	Inhalation	+	+
9	M	28	Inhalation	0	0
10	M	22	Inhalation	0	0
11	M	41	Ingestion	0	0
12	M	36	Inhalation	0	0

TABLE 1. — Summary of 12 cases of Carbon Tetrachloride poisoning

Case 4. This patient had cleaned his wife's dress with carbon tetrachloride while having a bottle of beer. He developed acute renal failure but recovered.

Case 5. This man was a safety engineer in a large factory. One evening after having several drinks of whiskey he fell asleep in bed while smoking a cigarette. The mattress caught fire but, having the tools of his trade at hand, he put the flames out with an extinguisher and went back to sleep. The next day he reported to the plant physician for treatment of burns. During the following two days he developed malaise, epigastric pain and vomiting. He was admitted to hospital with a diagnosis of alcoholic gastritis. Oliguria and abnormal urine findings with elevated blood urea nitrogen were noted. It was only then that the full story was obtained and properly interpreted. The fire extinguisher had contained carbon tetrachloride. He made a complete recovery.

Case 6. While drinking heavily one weekend, this man went to the cupboard for another bottle of gin and by mistake took carbon tetrachloride which had been placed in a gin bottle. He developed acute renal failure but recovered.

Case 7. This patient had consumed several quarts of beer during the afternoon and evening. That night she was troubled by coughing and went to the bathroom to take a cough mixture. In error she took carbon tetrachloride. She recognized her mistake immediately and tried to combat the effect by drinking milk. During the next two days abdominal and back pain, nausea, vomiting and drowsiness developed. She was seen on several occasions by two physicians who were told that she had become ill after drinking carbon tetrachloride. However the family was assured that if this were responsible, she would now be dead. Generalized convulsions started on the 13th day after exposure and she was sent to a hospital outdoor department. 720 ccs of clear urine were obtained by catheter. This urine contained albumin, a few RBCs and numerous WBCs Specific gravity was 1.008; the blood creatinine was 15 mgms per 100 ccs. She was, in fact, entering the diuretic phase of acute renal failure and eventually made a complete recovery.

Cases 8 and 9. These were electricians cleaning high tension equipment in a bucket of carbon tetrachloride. Neither considered this to be dangerous and had done it several times before but in the open air. This day the cold weather compelled them to work inside. Each had been equally exposed over a period of three hours. Case No. 8 had had 4 bottles of beer the night before and developed renal tubular damage. No. 9 had had no alcohol and suffered only slight dizziness on the day of exposure.

Case 10. This man was fumigating grain with a bromide and carbon tetrachloride mixture when the glass container broke. He suffered no serious illness.

Case 11. Patient accidently drank some carbon tetrachloride left in a ginger ale bottle. There were no serious consequences.

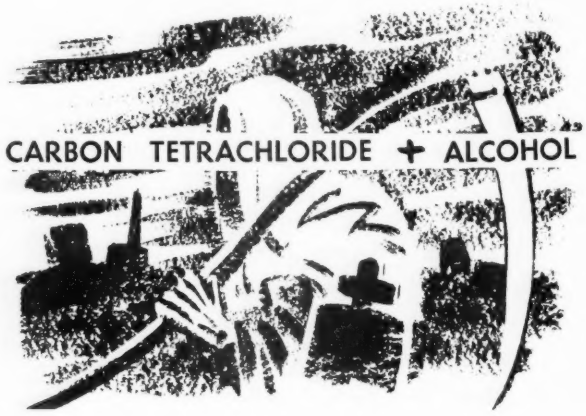
Case 12. This was a chemist who supervised a laboratory in which 20 people were employed. He used carbon tetrachloride to remove cement from table tops in his kitchen at home. Exposure was for two hours. Though he had marked nausea and vomiting during the next 3 or 4 days, he made an uneventful recovery and showed no renal or hepatic damage.

Discussion

It will be noted that in the first 8 cases, there was exposure to alcohol as well as to carbon tetrachloride. Severe renal damage followed in every instance. In the remaining four cases there was no ingestion of alcohol and no renal damage. In none of the 12 cases was there serious hepatic involvement.

It follows that a patient who has been exposed to carbon tetrachloride particularly if there was concomitant alcohol ingestion deserves close observation. Nausea and vomiting may occur without evidence of involvement of the liver or kidneys. Elevation of blood

pressure and back pain suggest renal involvement. The early laboratory investigation should include examination of the urine which in a typical case of acute tubular injury is scanty, has a specific gravity 1.010-1.015 and contains albumin, many red and white cells and casts. Under these circumstances azotemia will be present. Liver function should be studied by measuring the serum bilirubin and cephalin flocculation or similar tests.



The clinical course of the acute renal failure is similar to that which follows shock or trauma except that in the case of carbon tetrachloride the oliguria may be delayed 1-3 days after exposure, the oliguric phase is commonly shorter, lasting 6-14 days, and the biochemical changes are therefore usually severe.

If vomiting and diarrhoea have been severe it may be difficult to distinguish between renal damage and simple dehydration since both lead to oliguria. Rehydration must be carried out cautiously. If toxic renal damage exists pulmonary oedema is easily produced. However some intra-venous fluids should be given and in view of the possibility of liver involvement these should include 100-200 grams of glucose. By proceeding cautiously with rehydration, checking for early signs of oedema and watching the urine output, it is usually possible to distinguish between acute renal failure and simple dehydration.

The treatment of acute renal failure will not be discussed here. There are many excellent papers on the subject. Suffice it to say that these patients usually respond to conservative therapy and seldom need any form of dialysis. However they should be in a hospital where they can be followed by proper electrolyte studies. The principal danger is administration of excessive amounts of water and electrolytes during the oliguric phase leading to death from pulmonary oedema.

Conclusions

The hazards of carbon tetrachloride exposure have been discussed and illustrative cases presented. Carbon tetrachloride is extremely nephrotoxic. In fact it is one of the commonest causes of acute renal failure. The probability of renal damage is increased by concomitant ingestion of alcohol.

There are hazards in faulty diagnosis and treatment, but the greatest hazard is the lack of awareness of the dangers inherent in the use of carbon tetrachloride. The main problem is prevention of exposure. *Carbon tetrachloride should not be sold without suitable warning labels. Indeed the warnings should be strong enough to discourage its use in the household and small industries.* In many large industries less toxic compounds now replace carbon tetrachloride as a solvent and dry cleaner. These same substitutes would serve as well for smaller industries and in the home.

ASIATIC INFLUENZA

Recently epidemics of influenza caused by a new strain of influenza virus were reported from Hong Kong and other far eastern countries. Since it was first reported, the disease has spread southward and westward, and according to medical authorities, similar epidemics can be expected in Canada and U.S.A. later this year.

Characteristics

The influenza virus responsible is a new strain of Type A, completely different to any previously known strain. The epidemics have an unusually high attack rate; in the Phillipines as high as 19% of the population was affected.

The disease takes a mild form, with a short incubation period (as low as 24 hours), an acute stage lasting about 3 days, followed by a three or four day convalescent period. Mortality to date has been exceedingly low, less than one per 1000 cases, and these have been usually among infants or debilitated people, or as a result of complications such as pneumonia.

Signs and Symptoms

The clinical picture of 'Asiatic Flu' is similar to the influenza encountered in recent years' — low grade fever (100° — 103°), sore throat, headache, muscular aches and soreness, and respiratory symptoms such as coryza, sore throat and cough.

Prevention and Treatment

Since the virus is a new strain, previous vaccines are useless but vaccines prepared from the strain causing the present epidemic are now being manufactured. Since the disease is comparatively mild it is not practical or even desirable to vaccinate everyone and the vaccine will be used primarily for the maintenance of essential services.

Treatment consists of confinement to bed as long as there is evidence of fever. Aspirins will serve to relieve aching muscles and headache, and a light diet with plenty of fluids is advised.

Early and accurate reporting of cases to proper local health authorities is important.

ENGINEERING ASPECTS OF SMOKE CONTROL

by Sarto R. Plamondon, P.Eng., M.Sc., F.A.P.H.A., M.R.S.H.,
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The first factor which brought air pollution to the attention of the public was the nuisance caused by the soot, smell, and revolting blackness of smoke emitted by chimneys.

When coal was first used in Britain, the quality of the fuel and the conditions of burning were very poor. Its bituminous nature involving a high content of volatile matter together with the practice of burning in open hearth rendered it a very heavy smoke producer.

The use of this new type of fuel raised a lot of criticism from the public and their reaction prompted the Parliament of England in the thirteenth century to enact very drastic laws governing the use of "sea coal", as it was then called.

However, the flare-up of indignation of the population soon faded and any real application of these laws was never effected as the people became slowly accustomed to the sight of smoking chimneys. From time to time this question was revived by pamphleteers, and civic minded people, only to return soon into oblivion because of lack of leadership in trying to do something about it or simply through ignorance of how to deal with it. It remained a sort of accepted evil which even became at one time the mark of prosperity for cities. The smokiest meant the most prosperous, and this was the basis of slogans in advertising the development of industry. It was not until the end of the nineteenth century, in the 1870's that by-laws of any significance were passed, and equipment, supposedly efficient for the collection and control of smoke was manufactured. But these developments were not the real clue to the smoke problem.

Before proceeding with a discussion of the nuisance caused by smoke, let us first examine the dictionary definition of the word "smoke".

It is defined as "The visible exhalation given off by a burning or smoldering substance, esp. the gray, brown, or blackish mixture of gases and suspended carbon particles resulting from the combustion of wood, peat, coal, or other organic matter". This definition has a very extensive meaning and really covers the whole scope of the subject. Technically we can be more specific and define smoke as "An air suspension (aerosol) of particles, usually, but not necessarily, solid, often originating in a solid nucleus, formed from combustion or sublimation. Also defined as carbon or soot particles less than one micron in size which result from the incomplete combustion of carbonaceous materials such as coal, oil, tar, and tobacco".

Although there is a complete correlation between these two definitions, the second being of a more technical nature should interest the engineer who is concerned with the smoke problem, particularly because of the statement "particles . . . . . from incomplete combustion of carbonaceous materials".

This fact is accepted by any specialist in the smoke control field, but unfortunately and it may be added, surprisingly, in many instances, it is not always understood by people who should understand it.

Any engineer who is required to construct or erect any type of combustion apparatus, should bear this fact in mind when designing the system because the more complete the combustion, the less emission of smoke and the greater efficiency of the system. To realize this aim, he should keep in mind certain factors necessary for proper combustion.

When designing a combustion chamber the following principles should be applied: The volume of the chamber should be proportional to the quantity and quality of combustible used; the air fed by either forced or natural draft should be sufficient to produce complete combustion of the fuel; the method of feeding the combustible should also be taken into consideration; and it should afford the proper turbulence to ensure full oxidation of the combustion gases.

If any one, or a combination of these factors, is not considered in the designing of a combustion chamber, there is going to be trouble without any doubt, and it has been proven experimentally time and again.

The volume of the combustion chamber is of primary importance, and should be computed with great care. When coal is the combustible to be used, the height of the combustion chamber is the one dimension which has to be considered in the first place. There is a minimum height of combustion chamber for different varieties of coal. A lack of height might hinder the combustion of the distillation gases emitted when the

coal is burning, especially if highly volatile coal is used, and contact of these incompletely burned gases with the relatively cold surface of the boiler shell will inevitably produce smoke. Once the proper height of the chamber is determined, the width and length can be calculated easily to produce a volume which will answer all requirements.

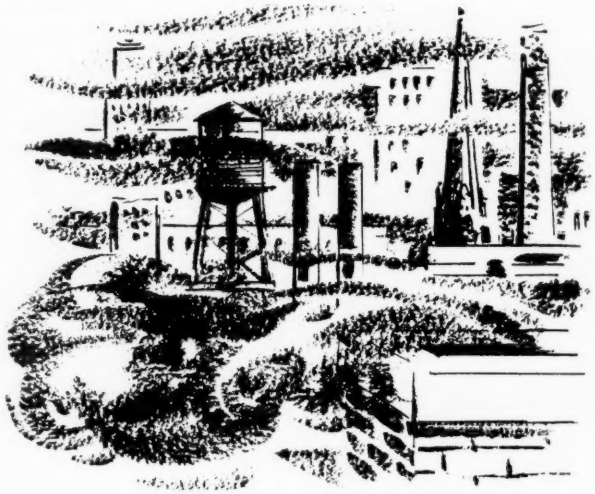
Secondly the quantity of air fed into the combustion chamber may become a source of poor combustion if not adequately controlled. The quantity of oxygen required to burn any type of fuel will be governed by the rate of combustion and the nature of the fuel—this is an elementary principle of combustion. To ensure this, it is common practice to provide for a quantity of air in excess of the amount considered necessary by theoretical calculation. Even this safety measure may not be effective if not carefully controlled.

The final point to be considered in the design of the combustion chamber is the type of fuel feeding apparatus to use, the choice of which is governed by the nature of the combustible. When coal is used, the quality has a great deal to do with the decision on the manner of feeding the boiler. Non-smoking coal, such as charcoal, coke, anthracite, can very well be fed by shovel in the boilers without any difficulty. Highly volatile coals of the bituminous type have to be fed by mechanical devices (stokers). Hand fixing of bituminous coal invariably results in a smoke nuisance except under the most favourable conditions. This is the reason why it is economical, wise and in fact compulsory under modern control regulations to feed bituminous coal with mechanical stokers.

A special problem associated with the burning of finely pulverized coal is the nuisance caused by the fly-ashes which are emitted by the chimney of such systems. Although it would seem to the naked eye that the chimneys are not smoking, they always emit a certain amount of fly-ash. This is due to the fact that when the coal is burned, either in suspension or on spreader stokers, very fine particles of ash are produced and are carried in the stream of air, through the chimney to the outside. The only remedy for this is the installation of fly-ash collectors which eliminate this nuisance to the neighbourhood.

When oil is used as fuel the same principles concerning the volume of the combustion chamber also apply, and naturally the installation of the burners should be in accordance with good engineering practice. Special attention should be given to the preheating of the oil when heavy or bunker oil is used.

The foregoing principles are usually well applied in present day installations and there is seldom any problem from modern systems. In fact these installations are generally very effective and once the initial operating difficulties have been corrected in the automatic controls, which are now part of these types of systems, any emissions of smoke which they might produce are either accidental or due to lack of supervision or maintenance.



The real engineering problem in controlling or eliminating smoke is found in the corrections to be effected on old combustion systems, and this is not always easy. Anybody, familiar with the situation, knows that strange as it may seem, the boiler room in a plant is the last part of equipment about which something is done. As long as it produces the necessary power, drives the machinery, heats the building, or takes care of the load it is subjected to, nobody worries about it. It usually takes a breakdown, which sometimes results in a catastrophe, to remind the users that a boiler can take just so much. This attitude is human! Who cares about his heart until he finds himself helpless in a hospital bed? Not until then does he realize that in order to prolong his life certain living regulations and precautions have to be observed, that is, if he is lucky enough to have this chance.

The boiler in an existing installation has generally been designed for a certain capacity with a good factor of safety for the future, but, in time, changes have occurred, more power is needed, the demand on the boiler increases, it becomes overloaded, methods of firing are improved to permit more fuel burning to produce more steam, entailing frequent repairs, and finally the system becomes an eyesore to the surroundings because it smokes to high heaven. Then, the boiler just cannot go on, it fails, the breakdown may cause a layoff of employees, production stops, and the owner faces a great loss and damage to his business particularly if this happens during a time of rush production. This is usually the time it does happen.

Preventive measures can be applied to this situation and herein lies the responsibility of the engineer. Not enough emphasis is given to the fact that when an installation is inspected, the owner should be made to understand the necessity for an annual inspection of his power plant to keep it in proper working condition.

Nor is there enough done to sell the idea that it is important in the operation of a boiler to use the best type of fuel, not the cheapest one; the price is of secondary importance. It has been proven that the use of more expensive fuel actually reduces operating costs because of the increased production of heat resulting from the more effective combustion and utilization of the fuel.

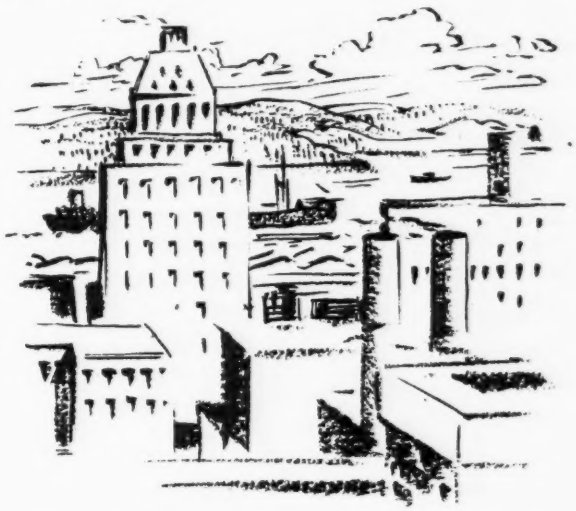
It should also be emphasized that smoke is unburnt fuel and as such, is money lost. Most users do not realize that that this is the consequence of operating an inefficient boiler installation. If a bituminous coal contains 35% volatile matter and half of this is not burned due to poor combustion, 17% of the cost of the coal is lost. In addition there will be an increase in the maintenance cost because the boiler becomes clogged with soot faster. And the insulating effects of excessive soot also cause further economic loss by reducing heat transfer in the boiler.

This introduces the question of how a smoke problem can be dealt with in an existing installation.

If the boiler is excessively overloaded there is no use trying to hide the fact; the only remedy is the addition of another unit. A boiler operates at its maximum efficiency when it is producing at a specified rate; if this limit is exceeded the efficiency decreases very rapidly. It is then only a matter of common sense to add to the installation. Some people will try to install all kinds of smoke reducing accessories on installations which are basically outdated, and after spending money on these gadgets they finally decide to do what should have been done in the first place—scrap, or increase the capacity of, the deficient apparatus. The money lost in these unprofitable experiments would have more than covered the cost of installing new equipment in the first place. These attempts are a complete loss of time and money, and a pointless way of trying to circumvent the problem.

If the boiler is not overloaded, excess smoke production might be due to faulty methods of firing, incorrect baffling of the gases in the boiler, or faulty design. One of the commonest causes of smoke production is burning soft coal in boilers with too low a setting. To overcome this, raise the boiler to increase the height of the combustion chamber or buy a better grade of coal. Steam-air jets have been known to help considerably but only WHEN THEY ARE MAINTAINED IN GOOD OPERATING CONDITIONS AND WHEN THEY ARE WELL INSTALLED. They sometimes are, if the fireman is cooperative, but they are often neglected and in need of repair, because the operator does not like the hissing sound they produce, or because he just does not care to turn the valve to put them on. If the method of firing or the baffles in the boilers need repair no delay should be allowed.

In redesigning old systems nowadays the popular trend is to change a coal burning unit into an oil burning one. When this is done it is usually found that the owner is under the impression that he will never hear from the smoke control officer again. How many times are we told: "We are putting in oil, so we will not get smoke any more". If it is planned to use the best grades of oils (such as are used in residential installation) this may be possible. But such is not the case if bunker oil is used. If the oil is not fed in the boiler at the right temperature with the right type of burner, and the right quantity of air, the smoke produced will be just as bad, and maybe worse than with coal. The chief cause of smoke production with these systems is the failure to preheat the oil before it reaches the burner; this usually happens when a boiler is put back into operation after a shutdown where the only means of preheating the oil is steam. To avoid this an auxiliary preheator should be used or the boiler heated up with light oil until enough steam is available to heat the heavier oil to the necessary temperature. The maintenance of the burners and the control of air are also very often the cause of inefficient burning, with resulting smoke. This is a matter of maintenance and the responsibility of the fireman who is in charge of the system.



There is no reason why a furnace should produce smoke. Granted there is a certain minimum which we have to put up with, under certain uncontrollable circumstances, but in a well balanced, well maintained installation this minimum can be easily maintained.

Unnecessary smoke production in a plant is indicative of poor management. Today attention is centred on increased production, reduction of unnecessary loss in materials; and in fact on achieving optimum efficiency in all phases of the manufacturing process. This attitude should also be applied to the operation of the power plant. The idea that there can be no fire without smoke, should be relegated to the past.

THE MEANING OF WORK AND RETIREMENT*

by Margery R. King, Ph.D., Executive Director,
The Canadian Mental Health Association, Toronto Branch.

It is not possible to discuss "Retirement" in any satisfactory way without also considering the question of "Work". This is because in order to understand the problems created by lack of employment, it is essential to explore the needs which work satisfies. With an understanding of these needs one is better able to understand the type of planning that must be done for retirement so that adequate substitutes can be found for the satisfactions previously met through employment.

In exploring these needs there are the obvious ones, such as the need for food and shelter, that a pay cheque will satisfy. However, these are certainly not only, or even the major, satisfactions associated with work. If they were, the type of employment would be of minor importance. Yet we know that many people accept a job at a lower rate of pay rather than give up other advantages. It is, therefore, the psychological satisfactions to be found through employment that we will explore. These are, in many instances, not as obvious but are as important as the satisfaction of physical needs.

There are four of these needs that I would like to draw to your attention. First, there is the need for inter-personal relationships. We are all very conscious of the child's dependence upon adults but we overlook the fact that this dependence is for more than the satisfaction of physical needs. His future capacity for inter-personal relationships is dependent upon the degree to which his need for a feeling of belonging is satisfied. The second psychological need is the need for learning, challenge, or progress. In childhood the environment constantly presents a challenging or learning situation, therefore, it is easy to satisfy this need for progress. However, as we grow older there is less of the unfamiliar in our environment. In order to live a full life, it is essential that we, as adults, continue to be challenged as it is through the meeting of challenges that we get our sense of progress. This sense of progress partly satisfies the third psychological need, the need for a sense of self-esteem. A complete lack of personal worth logically leads to suicide, therefore, self-esteem is essential to life. This means that we have to have "something" to build on and something to contribute to our inter-personal relationships with others. Part of this contribution helps to satisfy the fourth need, a need for some social purpose. We cannot live a completely selfish life: we must be able to see worth to others in what we do and what we are.

The pattern of these needs may be very uneven, with the importance of each need varying with the experiences of the individual involved. There is the individual to whom the need to belong is of major and prime importance. This is the "joiner" who belongs to many organizations because it gives him a feeling of security and importance. There is the individual in whom a need for progress seems to outweigh all others. This is the person who gets ahead at any cost. It is important to remember that needs are continuous. We are hungry; we satisfy our hunger; but we need to eat again within a few hours. Psychological needs follow the same pattern. They play a continuing and important role in shaping the life of the individual.

In exploring the meaning of work it is necessary to consider how it contributes to a satisfaction of the psychological needs. In childhood the need for inter-personal relationships is satisfied through two institutions in society, the family and the school. With adults the job situation is one of the major sources of this satisfaction. This becomes particularly important for the single person. Usually the inter-personal relationships found in the family are continued in the new family created through marriage. With the single person this continuity is broken as the older generation dies and they are cut off from close family ties. For this group, then, work may provide the major substitute for family and the major support in inter-personal relationships.

In the young, the satisfaction of the need for learning is easily met. Everything is new; everything must be learned. As we grow older, fewer and fewer situations are completely new; almost all have some elements

*Reprinted from the March 1957 issue of the "News Letter" to Industrial Nurses in Ontario published by the Division of Industrial Hygiene, Ontario Department of Health.

that are familiar. We, therefore, think of ourselves as having less learning ability. For many years psychologists and psychological tests tended to reinforce the old adage, "you can't teach an old dog new tricks". However, recent psychological studies have shown that there is no reduction in the capacity to learn up until the time that senility sets in. In other words, as adults, we meet few new situations in the course of everyday living, and we tend not to challenge ourselves by seeking the new and the unknown; therefore, we get out of the habit of learning.

The problems related to a sense of progress and the need for learning are probably quite different for men and women. When the majority of women start to work they do not expect to work the rest of their life whereas most men do. Men, therefore, see a need for continued learning in order to progress in the job situation. Frequently, by the time that women realize that they will be working for many years, they are being crowded by younger and better qualified people. This may be an extremely threatening situation that makes them shun the unknown rather than compete with others. This type of person can see no avenue of progress in her work and may get her sense of progression only through a growing bank account.

It is clear that work or employment can satisfy the need for a sense of learning, and of progress, in many different ways for many people. And so it is with the need for a feeling of self-esteem. The work situation may be the only area in which an individual has a sense of competence; therefore failure in meeting a new challenge here may be very damaging to that individual's sense of worth. This is the reason why the older person may fear and resent change in work methods as they may make him feel less capable and less secure. The more his self-esteem is threatened the more rigid and inflexible he becomes. Thus, while for many the satisfaction of a need for self-esteem comes through their work, for others the job situation may present threats and fears.

The need for a sense of social purpose also finds, for many people, its major expression through the employment field. Everyone gets satisfaction out of doing things for others and frequently the only opportunity he may have is through his job. When his job is changed or he is released, the older employee is threatened with an impairment or loss of social purpose and value.

The above has given a picture of some of the satisfactions for psychological needs which are gained through work, and, of some of the complications likely to arise. Obviously the satisfaction of one need may have to be at the expense of another. The denial of these needs may well bring about tensions and the health problems and inter-personal difficulties which tension in living creates.

In the light of what work means, let us look at retirement. Obviously psychological needs don't cease just because one no longer is employed, but because the usual channels of satisfaction are closed, the needs frequently are unsatisfied. Many of the dissatisfactions and the illnesses with which people seem to be plagued following retirement may well be caused by psychological factors.

Often the only preparation for retirement made by both the individual involved, and the Company with which he is employed, is in the financial field. However, if work itself has been the major source of an individual's security no amount of pension will serve as a substitute. Neither can one suddenly find new means of satisfying old needs. Thus, planning for retirement is necessary, not only by individuals, but also by employers and by society as a whole. It is necessary to recognize the needs that have been satisfied by work and to gain a better understanding of why retirement is such a threat. Any plan for the continued satisfaction of psychological needs following retirement must involve a new approach and real imagination.

The need for a sense of belonging might well be satisfied by some type of continued relationship with the Company, perhaps in a recreational area. It would, of course, have to be so planned that the ex-employee felt that he *really* belonged, not that he was merely invited in once a year. It might be possible to involve old and present employees in many projects outside the work area which would be of mutual benefit to both.

If we are to plan, realistically, for a satisfaction of the need for a sense of progress it is important that opportunities for continued learning be provided throughout the individual's life-time. It is too late to wait until after retirement; by then he is too threatened by the unknown aspects of retirement itself. It is important to help people to develop new interests and skills outside of the occupational field. Too frequently new learning gives satisfaction only if it results in promotion within the work field, where to be of value in retirement it needs to give satisfaction through the new freedom arising from the new interest itself. Such a sense of achievement will add to the individual's feeling of self-esteem that is in no way threatened by retirement.

If work has been the only outlet for his need for a sense of social usefulness, then retirement may indeed be a threat. However, there is unlimited opportunity for volunteer services providing that a person has kept sufficiently flexible and sufficiently in touch with other people that the unknown aspects of a volunteer service can be accepted. One of the great problems in this field is that frequently we associate earning with value. If an ethic with regard to volunteer service could be developed, greater satisfaction might be gained from giving services rather than selling services. A whole new field for the expression of social purposes could be opened up.

There has been a lot of discussion recently about the most desirable age for retirement. We are beginning to

recognize that this may differ from individual to individual. This means that certain individuals may still have a contribution to make to the employer, whereas others may not. Perhaps we need to think of this the other way around and consider whether certain individuals still need the security of work, while others may be able to find satisfaction for their basic psychological needs in retirement. The decision with respect to the age of retirement may eventually depend upon whether a person can navigate without the security of work.

This whole area is one which we have only begun to explore. It is one which presents a real challenge, particularly to those in the mental health field, as industrial health departments must be, for much of the imaginative planning must come from within industry itself. Only the people who are working with those who are approaching retirement can help realistically to plan "to add life to our years".

New Publication — Health and Safety in Welding

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This booklet was prepared by the Health and Safety in Welding Sub-Committee of the Institute of Welding in Great Britain. As noted in the introduction it was prepared as a concise reference for the welder, cutter, foreman, and supervisor. Practical aspects are stressed, rather than technical details. Most of the recommendations are based on relevant British legislation and standards. Other recommendations are based on the experience and expert knowledge of the committee members, who represent government, trade union, industry and university.

The publication is in four parts. Part I deals with gas welding and cutting, Part II with arc welding and cutting, Part III with ventilation, and Part IV with special precautions. Sections on allied processes, such as brazing, soldering, and metal spraying, are not included. In general, health and safety precautions for these are similar to those outlined for welding.

Health and safety aspects in gas welding and cutting are well covered. It is of interest to note that colour standardization for industrial gas cylinders is in effect in Britain; this is not the case in Canada. There is much practical information on gas valves and regulators, also recommendations for the proper care of cylinders. The formation of an explosive substance, copper acetylide, from copper and acetylene is pointed out; this is not too well known. Precautions in regard to fire hazards from gas welding are outlined. The more important fume exposures are touched upon. The storage of calcium carbide is subject to special legislation in Britain, and this is discussed in some detail.

Arc welding and cutting is coming into more prominence. This part also is well covered. Specifications for arc welding equipment are obtained from British standards. Exhaust gases from engine-drawn generators in confined spaces present a hazard, which may be overlooked. With arc welding, the dangers of electric shock, burns, eye injury, fire risks, and fume risks, are all noted. Special attention is given to the health hazard from exposure to welding fumes containing lead, cadmium, zinc, brass, bronze, or manganese. No mention is made of fluoride fluxes, which are a common cause of complaint in some welding operations. Beryllium is not specifically mentioned, but welding of beryllium alloys is not common. The section on protective clothing in arc welding is good. The standard recommendations for lens filters are similar to those in Canada. As pointed out, the need of eye and skin protection for helpers is sometimes overlooked.

From the health viewpoint, most trouble in welding comes from work in confined spaces. The ventilation of these requires special attention. General and local ventilation in welding shops is discussed. Gases and fumes in welding are produced by the action of heat on the materials present. One source, which is not mentioned in the booklet, is from ultraviolet radiation of the arc. This acts photochemically to produce ozone in the vicinity of the arc.

Part IV, dealing with special precautions, is of importance. The welding and cutting of vessels that have held combustibles is discussed fully; many welding accidents occur in this work. Precautions in regard to protection from sources of radioactivity are included in an appendix. Use of these sources to detect welding flaws is increasing. The recommendations set down are those given by the International Committee on Radiological Protection.

The booklet contains a page entitled "Do's and Don'ts", which is a list of practical health and safety pointers. Good illustrations and photographs also are included. The bibliography contains standards, government memoranda, legislation and selected articles. Reference is made throughout to pertinent British legislation and to British standards, which are not entirely applicable in Canada.

This report is of value to persons concerned with health and safety in welding. It achieves its aim of presenting a concise, non-technical reference for the worker and for his supervisor. It should prove of considerable value also to those engaged in the field of industrial hygiene.

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